JOURNAL OF ECONOMIC DEVELOPMENT
Volume 25, Number 1, June 2000

Foreign Trade and China's Economic Development: A Time-Series Analysis

Shuanglin Lin*

This paper examines the relationship between trade and economic growth based on China's national data for the period of 1952 to 1997. It is found that the growth rate of exports, the growth rate of imports, and the growth rate of the volume of trade are positively related to the growth rate of per capita GDP. It is also found that the labor force growth was positively related to economic growth.

I. Introduction

The effect of foreign trade on economic growth has been an important subject of debate for several decades. Many prior studies have found a positive relationship between the growth rate of trade and the growth rate of output. Studies by Balassa (1978, 1985), Feder (1983), Ram (1985), and Edwards (1992) are based on cross-sectional data covering various groups of developing countries for various time periods, while studies by Krueger (1978) and Ram (1987) are based on time-series data. These studies suggest that development strategies be based on trade liberalization, including reduction of the trade barriers and the opening of international trade to foreign competition. Other economists argued that trade expansion may not always be a good policy for all countries at all times (see, for example, Kavoussi (1985), Gray and Singer (1988), Sachs (1987, 1989), and Taylor (1991)).[1] This paper examines the relationship between the growth rate of exports, the growth rate of imports, and the growth rate of the volume of trade and the growth rate of per capita GDP based on the Chinese national data for the period 1952 to 1997.

For a long time in recent history, China adopted a close-door and isolation policy. In 1949, the People's Republic of China was founded. In the early 1950s, trade with the other socialist countries expanded rapidly. But the expansion of trade stopped due to the deterioration of the relationship with the Soviet Union. From the end of 1950s to the end of 1970s, China experienced continuous domestic political movements (e.g., the Great Leap

* Professor, Department of Economics, CBA 512, University of Nebraska, Omaha, NE68182. The author thanks Editor Woo Jung and an anonymous referee for helpful comments.

1. The direction of causality has always been an issue of debate. It is nontrivial to argue that GDP growth causes exports growth. Jung and Marshall (1985) used annual data on 37 countries to perform Granger causality tests. They found that in most cases it was not possible to establish unequivocally the direction of causality, and in only four cases it was found that export growth caused GDP growth.

Forward movement, the Socialist Education Movement, and the Cultural Revolution). The self-destructive political movements placed the Chinese economy in chaos and made foreign trade stagnant. In the late 1970s, China adopted an outward-oriented development policy. From 1978 to 1997, real exports increased from 16.76 billions of yuan to 397.91 billions of yuan, a 24-fold increase. The export-GDP ratio rose from 4.63% in 1978 to 20.3% in 1997. Thus, exports increased faster than GDP.[2]

A study of the Chinese experience will provide some policy implications for large developing countries as well as for other former socialist countries. The rest of this paper is organized as follows. Section II presents regression models and discusses data and defines variables. Section III analyzes regression results based on the national data from 1952 to 1997. Section IV provides conclusions.

II. Regression Model, Data, and Definition of Variables

Foreign trade benefits a developing country through obtaining advanced technology and the flow of ideas embodied in the imported products. Foreign trade also increases efficiency of domestic firms, which are forced to improve production technologies to compete in the domestic and international markets. Foreign trade may also be accompanied by foreign direct investment, which increases a developing country's capital stock and the level of technology. The theoretical framework is based on an aggregate production function in which capital, labor, government expenditures, and the level of technology are inputs. In this paper, the level of foreign trade approximates the level of technology. The following regression equation will be used in our empirical analysis:[3]

$$\dot{y} = a_0 + a_1\dot{T} + a_2\dot{L} + a_3 i + a_4 g + a_5\dot{P} + a_6 d + u, \qquad (1)$$

where $\dot{y}$ is the rate of per capita output growth, $\dot{T}$ can be either the growth rate of exports, the growth rate of imports, or the growth rate of the volume of trade, i is the investment share in output, g is government expenditure share in total output, $\dot{L}$ is the growth rate of the labor force, $\dot{P}$ is the growth of the population, and d is a dummy variable, which distinguishes the pre- and post-reform periods. a_1, the coefficient on capital, should be positive. a_2, the output elasticity of labor, should be positive theoretically. a_3, the coefficient of investment should be positive. a_4, the coefficient of the size of government, can be either positive or negative depending on productivity of government expenditures.

2. *Statistical Yearbook of China*, 1997, 1998.

3. The regression equation can be obtained by dividing the total output by the population, differentiating the resulted function, and adding a constant term, a dummy variable, and a stochastic term. Previous studies of economic growth based on the aggregate production technology include Feder (1983) and Ram (1987), Aschauer (1989), and Romer (1990). A detailed derivation is available on request.

a_5, coefficient on the population growth, can be either negative or positive theoretically.[4]
a_6, the coefficient on the dummy variable could be positive.

Most of the data were from the recently published statistical book, *The Gross Domestic Product of China (1952-1995)* and various issues of the *Statistical Yearbook of China*.[5] The definition of each variable is as follows.

$\dot{y}$: Annual growth rate of real per capita GDP. It is calculated as follows: $\dot{y} = ln(y_t) - ln(y_{t-1})$, where y_{t-1} and y_t is the real per capita GDP for year $t-1$ and year t, respectively.

$\dot{T}$: Annual growth rate of the volume of trade (real exports plus real imports). It is calculated as follows: $\dot{T} = ln(T_t) - ln(T_{t-1})$, where $T_t (T_t = X_t + M_t)$ and T_{t-1} are volumes of trade for year t and year $t-1$, respectively.

$\dot{X}$: Annual growth rate of real exports. It is calculated as follows: $\dot{X} = ln(X_t) - ln(X_{t-1})$, where X_t and X_{t-1} are real exports for year t and year $t-1$, respectively.

$\dot{M}$: Annual growth rate of real imports. It is calculated as follows: $\dot{M} = ln(M_t) - ln(M_{t-1})$, where M_t and M_{t-1} are real imports for year t and year $t-1$, respectively.

$\dot{P}$: Annual growth rate of population. It is calculated as follows: $\dot{P} = ln(POP_t) - ln(POP_{t-1})$, where POP_t and POP_{t-1} are the population for year t and year $t-1$, respectively.

$\dot{L}$: Annual growth rate of the labor force. It is calculated as follows: $\dot{L} = ln(L_t) - ln(L_{t-1})$, where L_t and L_{t-1} are the labor force for year t and year $t-1$, respectively.

i: The share of investment in GDP. It is calculated as follows: $i = I_t / Y_t$, where I_t is total investment in year t, and Y_t is GDP in year t.

g: The share of government spending in GDP. It is calculated as follows: $g = G_t / Y_t$, where G_t is government spending in year t, and Y_t is GDP in year t.

The mean of the annual growth rate of exports, $\dot{X}$, was 10.7%, and the mean of the annual growth rate of imports, $\dot{M}$, was 9.4%. Both the growth rate of exports and the growth rate of imports reached their lowest points in 1961 (the year immediately after the Great Leap Forward movement), with the growth rate of exports being −43.1% and the growth rate of imports being −56.6%. Exports and imports have grown rapidly since 1979.

4. Based on the neoclassical production function, with labor, capital, etc. as inputs, the per capita output (total output divided by the population, as well as the growth rate of per capita output does depend on labor force growth as well as population growth. In empirical studies of economic growth, economists usually use only population, either because the data on labor force is not available or because the growth rate of labor and the growth rate of population are correlated. In the Chinese case, both the growth rate of labor and the growth rate of the population are available, and the two are not highly correlated. Therefore, we put both in some regression equations. We also presented regression results without population growth.

5. Chow (1993) argued that Chinese statistics, by and large, are internally consistent and accurate enough for empirical work.

The structure of exports and imports has also changed dramatically. Primary product exports have been declining and manufactured product exports have been growing. Table 1 shows the total value of exports and imports by category. In 1980, primary product exports account for more than 50% of total exports, while in 1997 it was only 13.1% of total exports.

Table 1 Total Value of Imports and Exports by Category

(Billions of yuan at 1978 constant price)

	Exports			Imports		
Year	Primary Products	Manufactured Products	Machinery and Transportation Equipment	Primary Products	Manufactured Products	Machinery and Transportation Equipment
1980	126.00	124.50	11.65	96.21	180.53	70.77
1981	154.60	177.39	16.40	121.35	210.76	88.49
1982	165.15	201.65	20.75	125.45	191.46	52.65
1983	165.67	217.09	21.03	100.02	268.34	68.68
1984	227.40	270.68	28.45	99.24	423.06	138.05
1985	320.54	313.44	17.90	122.60	856.81	376.42
1986	290.03	506.11	28.15	145.35	958.56	431.77
1987	338.87	671.18	44.59	177.11	929.73	374.11
1988	310.15	712.83	59.61	216.75	973.26	359.47
1989	275.86	685.34	70.88	215.04	866.94	333.10
1990	368.39	1071.47	129.58	228.49	1008.55	390.63
1991	402.50	1388.56	178.23	270.12	1320.20	488.66
1992	415.62	1662.37	324.15	323.32	1648.13	766.90
1993	376.56	1696.35	345.29	321.07	2027.83	1017.27
1994	547.24	2813.82	608.91	457.29	2755.34	1431.86
1995	504.82	2990.95	737.95	573.71	2529.77	1236.89
1996	484.15	2851.72	779.79	561.77	2504.08	1209.47
1997	521.19	3457.94	951.83	623.34	2477.28	1149.09

Note: Calculated by the author based on the data are from *Statistical Yearbook of China*, 1995, 1997, 1998. The data were given in US dollars originally and were converted to yuan by using the US dollar-Chinese yuan exchange rates. The exchange rates are calculated based on the total exports and total imports data. General retail price index was used to convert the figures in 1978 constant price. The data for years before 1980 are not available.

The mean of the share of government spending in GDP (the size of government) was 24.7%. The share of government spending in income reached 44.9% in 1960. In 1984, the share of government spending in GDP was 30.9%. The size of government has been decreasing since then. In 1997, the share of government spending in GDP was only 12.3%. The reason is that tax revenues in China have not grown proportionally with the GDP.

The mean of the investment share in GDP was 25.9%. The share of investment in GDP was generally low before 1975, except 1958, 1959 and 1960 (the period called the "Great Leap Forward"). During this period, the government emphasized heavy industry, and allocated a lot of resources in industrial sectors. The share of investment in GDP was

generally high in the 1980s and the 1990s. The investment share in GDP reached 37.5% in 1993, the highest in the past 40 years.

The average annual growth rate of population was 1.7% from 1952 to 1997. The population growth rate was down to −1.5% in 1960, reached its maximum in 1965 at 2.91%, and was 1.05% in 1997. The average annual growth rate of the labor force was 2.69% from 1952 to 1997. The growth rate of the labor force reached 11.25% in 1958 (the beginning of the Great Leap Forward movement), and it was negative in 1959, 1960, and 1961.

There exists strong multi-collinearity between exports and imports, with the correlation coefficient being 0.72. This is not surprising, since the trade account never had a large surplus or deficit in China. Therefore, exports and imports were highly correlated. Thus, in regression analyses, we will not put these strongly correlated variables in the same regression.

III. Regression Results

Table 2 shows the regression results concerning the relationship between trade and the growth rate of per capita GDP. In regression (1), the coefficient for the growth rate of export, $\dot{X}$, is positive and statistically significant, with the *t*-value being 4.39. In regression (2), the estimate of the coefficient of the growth rate of imports, $\dot{M}$, is positive and statistically significant, with the *t*-value being 5.49. In regression (3), the coefficient of the growth rate of the volume of trade, $\dot{T}$, is 0.30 and *t*-value is 5.58. Thus, all the trade variables are positively related to the growth rate of per capita GDP.

Table 2 Regression Results on Foreign Trade and per Capita GDP Growth (1952-1997)[a]

eq.	*intercept*	$\dot{X}$	$\dot{M}$	$\dot{T}$	$\dot{L}$	i	g	$\dot{P}$	*dummy*	R^2	*obs.*
(1)	−0.160	0.275			1.346	0.411	0.169			0.514	45
	(−2.14)	(4.39)**			(2.85)**	(2.32)*	(1.11)				
(2)	−0.084		0.244		1.314	0.237	0.032			0.590	45
	(−1.19)		(5.49)**		(3.03)**	(1.63)	(0.23)				
(3)	−0.115			0.300	1.254	0.310	0.098			0.595	45
	(−1.67)			(5.58)**	(2.90)**	(1.89)+	(0.71)				
(4)	−0.288	0.218			1.069	0.706	0.205	3.308		0.562	45
	(−3.04)	(3.30)**			(2.26)*	(3.18)**	(1.39)	(2.07)*			
(5)	−0.212		0.208		1.049	0.559	0.088	3.016		0.631	45
	(−2.33)		(4.49)**		(2.41)*	(2.65)**	(0.64)	(2.09)*			
(6)	−0.227			0.255	1.030	0.565	0.140	2.717		0.627	45
	(−2.51)			(4.43)**	(2.36)*	(2.67)*	(1.02)	(1.84)+			
(7)	−0.286	0.220			1.070	0.708	0.198	3.271	−0.002	0.563	45
	(−2.66)	(2.99)**			(2.23)*	(3.06)**	(0.93)	(1.82)	(−0.05)		
(8)	−0.214		0.207		1.048	0.556	0.096	3.048	0.002	0.631	45
	(−2.10)*		(4.20)**		(2.37)*	(2.53)*	(0.48)	(1.927)+	(0.05)		

Table 2 (Continued)

eq.	*intercept*	$\dot{X}$	$\dot{M}$	$\dot{T}$	$\dot{L}$	i	g	$\dot{P}$	*dummy*	R^2	*obs.*
(9)	−0.213			0.263	1.037	0.579	0.096	2.506	−0.010	0.628	45
	(−2.06)*			(4.15)**	(2.34)*	(2.64)*	(0.48)	(1.52)	(−0.30)		

Notes: [a] All the variables are defined in Section 3, where $\dot{X}$ = the growth rate of real exports; $\dot{M}$ = the growth rate of real imports; $\dot{T}$ = the growth rate of the volume of trade (exports + imports). $\dot{Y}$ = annual growth rate of real per capita GDP; $\dot{L}$ = annual growth rate of labor force; i = share of investment in GDP; g = share of government spending in GDP; $\dot{P}$ = annual growth rate of population; *dummy* = dummy variable with a value of 1 for the years of 1979-1997 and 0 otherwise. Detailed explanations of the variables are provided in Sector 2. *obs* = number of observations.

t-values are given in the parentheses.

+ Statistically significant at the 10% level.

* Statistically significant at the 5% level.

** Statistically significant at the 1% level.

Also, regression (1)-(3) include the growth rate of the labor force, $\dot{L}$, the share of investment in GDP, i, and the share of government spending in GDP, g. The coefficient for the growth rate of the labor force is positive and statistically significant in all regressions. This is consistent with the results obtained by most empirical studies of growth. The labor force has grown faster than the population because more and more women joined the labor force. The share investment in GDP is positively related to the growth rate of per capita GDP, and the *t*-value is high in most regressions, indicating investment is important for growth.

The share of government expenditures in GDP has a *positive* but insignificant coefficient. This result is contrary to many studies based on cross-country regressions. Landau (1983), Barro (1989), and Romer (1990) found that the share of government spending is significantly negatively related to the growth rate of per capita GDP. Other studies, including Levine and Renelt (1992), found that the coefficient of the share of government spending in GDP is negative, but it is not statistically significant. Barro (1990), in an endogenous growth model, showed that when government spending share in output is small, then an increase in government spending will increase the growth rate; while when the government spending share in output is large, then an increase in government spending will reduce the growth rate of output. Thus, there exists an optimal size of government. Based on this theory, government spending in China is not high enough to reduce the growth rate.

In regression (4)-(6), we include the growth rate of population, $\dot{P}$.[6] The rate of population growth and the rate of labor force growth can be substantially different since it takes many years for the newborn to join the labor force. Many empirical studies assumed that the population growth and the labor force growth are strongly correlated and used the growth rate of population to represent the growth rate of the labor force (see Romer (1990)). In fact, in the Chinese case, the Pearson correlation coefficient between the growth rate of

6. Based on a neoclassical production function with labor as one of the inputs, we can show that the growth rate of per capita output depends on both the growth rate of labor and the growth rate of population.

labor and the growth rate of the population is not high at all (about 0.34).

With the growth rate of population included in regressions (4)-(6), the coefficients of growth rates of exports, imports and total volume of trade remain positive and highly significant. The coefficient for the share of investment in GDP remains positive but *t*-value increases significantly. The coefficient of the share of government expenditure in GDP is still positive but insignificant.

The population growth rate is positively related to the growth rate of per capita GDP. This finding is contrary to the view of many policy makers, as well as the empirical finding by Barro (1989) where the growth rate of population is significantly negatively related to the rate of economic growth in cross-country analyses. But it is consistent with most of the empirical findings in the literature (see Johnson (1993) for a discussion of this issue).

In regressions (7)-(9), we add a dummy variable to distinguish the pre- and post-reform periods (before 1979 and after 1979). The dummy variable is used because some other factors besides the variables included here may affect economic growth. All the trade variables, the growth rate of the labor force, and the share of investment in GDP remain highly significant. However, to our surprise, the dummy variable, *dummy*, is positive but statistically insignificant. This tells us that all the reform efforts might be well represented by the trade variable and the other variables.

IV. Conclusion

This paper has examined the relationship between trade and economic growth based on China's national data for the period of 1952 to 1997. It has been found that the growth rate of exports, the growth rate of imports, and the growth rate of the volume of trade are positively related to the growth rate of per capita GDP. It has also been found that investment and labor force growth were positively related to economic growth. The regression results appear to be very robust. These results suggest that, to keep the economy at a high level of growth, China should actively engage in the world economy and continue its trade promotion policy. These results also suggest that other developing countries base their developing strategy on trade promotion.

References

Ashauer, D. (1989), "Is Public Expenditure Productive?" *Journal of Monetary Economics*, 23, 177-200

Balassa, B. (1978), "Exports and Economic Growth: Further Evidence," *Journal of Development Economics*, 5, 181-189.

_____ (1985), "Exports, Policy Choices, and Economic Growth in Developing Countries After the 1973 Oil Shock," *Journal of Development Economics*, 18, 23-35.

Barro, R. (1989), "A Cross Country Study of Growth, Saving and Government," *NBER Working Paper* #2855, Feb.

_____ (1990), "Government Spending in a Simple Model of Endogenous Growth," *Journal of Political Economy*, 98, 103-25.

China's National Bureau of Statistics (1984, 1998), *Statistical Yearbook of China*, Beijing: China Statistical Publishing House.

_____ (1997), *The Gross Domestic Product of China, 1952-1995*, Dalian: Dongbei University of Finance and Economics Press.

Chow, G.C. (1993), "Capital Formation and Economic Growth in China," *Quarterly Journal of Economics*, 108, 809-842.

Edwards, S. (1992), "Trade Orientation, Distortions, and Growth in Developing Countries," *Journal of Development Economics*, 39, 31-57.

Feder, G. (1983), "On Exports and Economic Growth," *Journal of Development Economics*, 12, 59-73.

Johnson, D.G. (1993), "Can There Be Too Much Human Capital - Is There a Population Problem?" in *Human Capital and Economic Development*, eds. by Sisay Asefa and Wei-Chiao Huang, W.E. up John Institute for Employment Research, Kalamazoo, Michigan.

Jung, W.S., and P.J. Marshall (1985), "Exports, Growth and Causality in Developing Countries," *Journal of Development Economics*, 18, 1-12.

Kavoussi, R.M. (1985), "International Trade and Economic Development: The Recent Experience of Developing Countries," *Journal of Developing Areas*, 19, 379-392.

Krueger, A. (1978), *Foreign Trade Regimes and Economic Development: Liberalization Attempts and Consequences*, Cambridge Mass.: Ballinger.

Landau, D. (1983), "Government Expenditure and Economic Growth: A Cross-Country Study," *Southern Economic Journal*, 49, 783-92.

Levine, R., and D. Renelt (1992), "A Sensitivity Analysis of Cross-Country Growth Regressions," *American Economic Review*, 84, 942-963.

Ram, R. (1985), "Exports and Economic Growth: Some Additional Evidence," *Economic Development and Cultural Change*, 33, 415-425.

_____ (1987), "Exports and Economic Growth in Developing Countries: Evidence from Time-series and Cross Section Data," *Economic Development and Cultural Change*, 36, 51-72.

Romer, P.M. (1990), "Capital, Labor, and Productivity," *Brookings Papers on Economic Activity: Microeconomics*, 337-367.

Sachs, J.D. (1987), "Trade and Exchange Rate Policies in Growth Oriented Adjustment Programs," in *Growth Oriented Growth Programs*, eds. by Vittorio Corbo a, Morris Goldstein, and Mohsin Khan, Washington, DC: IMF.

_____ (1989), "The Debt Overhang of Developing Countries," *In Debt, Stabilization and Development Essays in Memory of Carlos Diaz-Alejandro*, eds. by Guillermo A. Calvo and *et al*., Oxford: Blackwell, 80-102.

Singer H.W., and P. Gray (1988), "Trade Policy and Growth of Developing Countries: Some New Data," *World Development*, 16, 395-403.

Taylor, L. (1991), "Economic Openness: Problems to the Century's End," in *Economic Liberalization: No Panacea*, ed. by Tariq Banuri, Oxford and New York: Oxford University Press, Clarendon Press, 99-147.